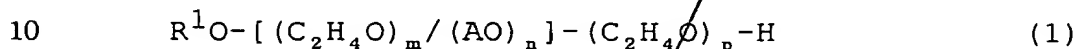


## CLAIMS

1. A nonionic surfactant comprising an aliphatic alcohol alkylene oxide adduct (A),

5 said (A) being directly produced by adding an alkylene oxide (b1) to an aliphatic alcohol (a1) and satisfying the following (i), (ii) and (iii):

(i) comprising one compound represented by the following formula (1) or a mixture of two or more thereof:



wherein  $R^1$  is an aliphatic hydrocarbon group containing 8-24 carbon atoms or a cycloaliphatic hydrocarbon group containing 8-24 carbon atoms; A is an alkylene group containing at least 3 carbon atoms; m is 0 or an integer of 1 or more, the average thereof being in the range of 0-4, n is 0 or an integer of 1 or more, the average thereof being in the range of 0-3, p is 0 or an integer of 1 or more, the average thereof being in the range of 1-80, (m+n+p) is an integer, the average thereof being in the range of 3-81, and the average of (m+p)/(m+n+p) is at least 0.5; and, in case of  $m \neq 0$  and  $n \neq 0$ ,  $\{(C_2H_4O)_m/(AO)_n\}$  represents block addition or random addition;

(ii) having a ratio  $M_w/M_n$  of a weight-average molecular weight ( $M_w$ ) to a number-average molecular weight ( $M_n$ ) satisfying the following relation (2) or (3):

25 
$$M_w/M_n \leq 0.030 \times \ln(v) + 1.010 \quad (\text{in case of } v < 10) \quad (2)$$

$$M_w/M_n \leq -0.026 \times \ln(v) + 1.139 \quad (\text{in case of } v \geq 10) \quad (3)$$

wherein v represents the average of (m+n+p) in the above general formula (1); and

(iii) having a distribution constant (c), determined by the following equation (4), of 1.0 or less, this being required only in case of v up to 12:

30 
$$c = (v + n_0/n_{00} - 1) / [\ln(n_{00}/n_0) + n_0/n_{00} - 1] \quad (4)$$

wherein v is the same in the above,  $n_{00}$  represents the molar number of the aliphatic alcohol (a1) used in the reaction, and

*a*  
 $n_0$  represents the molar number of the aliphatic alcohol (a1) unreacted.

2. The nonionic surfactant according to Claim 1,  
 5 wherein the  $n$  in the general formula (1) is 0 or an integer of 1 or more, the average thereof being in the range of 1-3.

3. The nonionic surfactant according to Claim 1,  
 10 wherein the  $n$  in the general formula (1) is 0, and the (A) has a ratio  $M_w/M_n$  of a weight-average molecular weight ( $M_w$ ) to a number-average molecular weight ( $M_n$ ) satisfying the following relation (6) or (7) instead of the relation (2) or (3):

$$M_w/M_n \leq 0.020 \times \ln(v) + 1.010 \quad (\text{in case of } v < 10) \quad (6)$$

$$15 \quad M_w/M_n \leq -0.026 \times \ln(v) + 1.116 \quad (\text{in case of } v \geq 10) \quad (7)$$

wherein  $v$  represents the average of  $(m+p)$  in the above general formula (1).

20 *sub*  
 4. The nonionic surfactant according to Claim 1, which satisfies any of the following (v) - (viii):

(v) comprising (A) having an HLB of 5-13,  
 and having an emulsifiability index  $s$  for a mineral oil, having an aniline point of 70°C and a viscosity of 15-25 mPa · s at 25°C, of at least 8;

25 (vi) comprising (A) having an HLB of 11-19,  
 and having an emulsifiability index  $t$  for an oxidized polyethylene wax, having a weight-average molecular weight of 9000-10000 and an acid number of 22-24, of at least 8;

(vii) comprising (A) having an HLB of 7-15,  
 30 and having a index of detergency for a synthetic dirts of the following formulation [standardizing detergency of nonyl-phenol ethylene oxide 9.5 moles adduct as 100], supproted on a slide glass, of at least 100:

(synthetic dirts formulation) tallow 16.6%  
 35 soybean oil 16.6%

monoolein	0.4%
oil red	0.2%
<u>chloroform</u>	<u>66.2%</u>
total	100.0%;

- 5 (viii) comprising (A) having an HLB of 10-14, and having a viscosity index of 5% aqueous solution [standardizing viscosity of 5% aqueous solution of nonylphenol ethylene oxide 8.5 moles adduct as 100] of at least 50.

- 10 5. The nonionic surfactant according to Claim 1, wherein (A) is one having a freezing point satisfying the following relation (9) and having an HLB of 7-15:

$$1.61x-102 \leq y \leq 1.61x-92 \quad (9)$$

- 15 wherein x represents % by weight of the units represented by (C<sub>2</sub>H<sub>4</sub>O) in the general formula (1) formed by addition of ethylene oxide, and y represents the freezing point (°C) of (A).

- 20 6. The nonionic surfactant according to Claim 1, wherein said (a1) is one selected from the group consisting of saturated aliphatic alcohols, unsaturated aliphatic alcohols and cycloaliphatic alcohols, containing 8-24 carbon atoms.

- 25 7. The nonionic surfactant according to Claim 1, wherein said (a1) is one or two or more selected from the group consisting of octyl alcohol, nonyl alcohol, decyl alcohol, undecyl alcohol, dodecyl alcohol, tridecyl alcohol, myristyl alcohol, cetyl alcohol, stearyl alcohol, nonadecyl alcohol, octenyl alcohol, decenyl alcohol, dodecenyl alcohol, 30 tridecenyl alcohol, pentadecenyl alcohol, oleyl alcohol, gadoleyl alcohol, linoleyl alcohol, ethylcyclohexyl alcohol, propylcyclohexyl alcohol, octylcyclohexyl alcohol, nonylcyclohexyl alcohol and adamantyl alcohol.

8. An emulsifier, dispersant, solubilizer, detergent,

penetrating agent or wetting agent, comprising the nonionic surfactant according to any one of Claims 1-7.

9. A process for producing an aliphatic alcohol  
5 alkylene oxide adduct,

which comprises addition reaction of an aliphatic alcohol alkylene oxide adduct (e), obtainable by adding 1-2.5 moles on the average of an alkylene oxide (b2) containing at least two carbon atoms to an aliphatic alcohol (a2) containing  
10 1-24 carbon atoms in the presence of a catalyst (d) providing an adduct having a distribution constant  $c'$  of 1.0 or less as determined by the following equation (4'),

with an alkylene oxide (b3) containing at least two carbon atoms in the presence of an alkaline catalyst (f):

$$15 \quad c' = (v' + n_{00}'/n_{00}' - 1) / [\ln(n_{00}'/n_0') + n_0'/n_{00}' - 1] \quad (4')$$

wherein  $v'$  represents the average addition molar number of alkylene oxide added per 1 mole of the aliphatic alcohol (a2),  $n_{00}'$  represents the molar number of the aliphatic alcohol (a2)  
20 used in the reaction, and  $n_0'$  represents the molar number of the aliphatic alcohol (a2) unreacted.

10. The production process according to Claim 9,  
wherein the catalyst (d) is at least one selected from  
25 the group consisting of perhalogenoic acids or salts thereof, sulfuric acid or salts thereof, phosphoric acid or salts thereof and nitric acid or salts thereof.

11. The production process according to Claim 10,  
30 wherein the catalyst (d) is a perchlorate of a divalent or trivalent metal.

12. The production process according to Claim 9,  
wherein the catalyst (d) is used in an amount of 0.001-1  
35 part by weight per 100 parts by weight of the total of (a2) and

(b2) .

13. The production process according to Claim 9,  
wherein (e) is one obtainable by introducing (b2) into  
5 (a2) under a pressure of  $-0.8-5 \text{ kgf/cm}^2$  at a temperature of  
80-200°C followed by carrying out aging at a temperature of  
80-200°C until the pressure within the reaction system reaches  
equilibrium.

10 14. The production process according to Claim 9,  
wherein the catalyst is removed from the polymerization  
product, after termination of the addition-reaction of (b3),  
through adsorption treatment by adding an adsorbent and  
optionally a filter aid, followed by filtering operation.

15 15. An anionic surfactant obtainable by anionization  
of an aliphatic alcohol alkylene oxide adduct (A'),  
said (A') being directly produced by adding an alkylene  
oxide (b1) to an aliphatic alcohol (a1) and satisfying the  
20 following (ii'), (iii') and (iv):  
(ii') having a ratio  $M_w/M_n$  of a weight-average molecular weight  
( $M_w$ ) to a number-average molecular weight ( $M_n$ ) satisfying the  
following relation (2') or (3'):

25 
$$M_w/M_n \leq 0.030 \times \ln(v'') + 1.010 \quad (\text{in case of } v'' < 10) \quad (2')$$

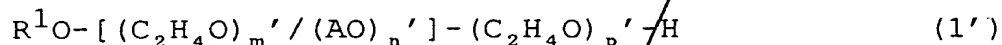
$$M_w/M_n \leq -0.026 \times \ln(v'') + 1.139 \quad (\text{in case of } v'' \geq 10) \quad (3')$$

wherein  $v''$  represents the average of  $(m' + n' + p')$  in the following  
general formula (1');  
30 (iii') having a distribution constant  $c''$ , determined by the  
following equation (4''), of 1.0 or less, this being required  
only in case of  $v$  up to 12:

35 
$$c'' = (v'' + n_0/n_{00} - 1) / [\ln(n_{00}/n_0) + n_0/n_{00} - 1] \quad (4'')$$

wherein  $v''$  is the same in the above,  $n_{00}$  represents the molar number of the aliphatic alcohol (a1) used in the reaction, and  $n_0$  represents the molar number of the aliphatic alcohol (a1) unreacted; and

- 5 (iv) comprising one compound represented by the following general formula (1'), or a mixture of two or more thereof:



wherein  $R^1$  is an aliphatic hydrocarbon group containing 8-24 carbon atoms or a cycloaliphatic hydrocarbon group containing  
 10 8-24 carbon atoms; A is an alkylene group containing at least 3 carbon atoms;  $m'$  is 0 or an integer of 1 or more, the average thereof being in the range of 0-5,  $n'$  is 0 or an integer of 1 or more, the average thereof being in the range of 0-5,  $p'$  is 0 or an integer of 1 or more, the average thereof being in the range of 0-10,  $(m'+n'+p')$  is an integer, the average thereof being in the range of 1-20, and average of  $(m'+p') / (m'+n'+p')$   
 15 is at least 0.5; and, in case of  $m' \neq 0$  and  $n' \neq 0$ ,  $\{(C_2H_4O)_{m'} / (AO)_{n'}\}$  represents block addition or random addition;

20 16. The anionic surfactant according to Claim 15, wherein said anionization is sulfation.

17. The anionic surfactant according to Claim 15, wherein said anionization is phosphorylation.

25 18. The anionic surfactant according to Claim 15, wherein said anionization is carboxyetherification.

30 19. The anionic surfactant according to Claim 15, wherein said anionization is sulfosuccination.

20. A detergent composition comprising said anionic surfactant according to Claim 15.

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378</
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